

AMENDMENTS

IN THE CLAIMS

Please amend the claims to read as follows:

1. (Currently Amended) A voltage-controlled tunable comb-ring type filter comprising:
a first ring or combline resonator;
a second ring or combline resonator coupled to said first ring or combline resonator;
a third resonator coupled to said second ring or combline resonator and cross coupled to said first ring or combline resonator, wherein at least one of said resonators includes at least one voltage tunable dielectric capacitor and wherein the cross coupling is realized by a transmission line shorted on both ends of at least one of said first, second or third resonators or by placing a ring resonator in a different layer relative to a combline resonators or by keeping two comb-line resonators straight and in proximity to a ring resonator.
2. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, wherein said first resonator is a combline type resonator.
3. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, wherein said second resonator is a ring type resonator.
4. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, wherein said third resonator is a combline type resonator.

5. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, further comprising an input transmission line connected with said first resonator.
6. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, further comprising an output transmission line connected with said third resonator.
7. Cancel claim 7.
8. Cancel claim 8.
9. Cancel claim 9.
10. Cancel claim 10.
11. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 1, wherein each of said first, second and third resonators includes at least one ~~variable~~ voltage tunable dielectric capacitor.
12. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 10, further comprising biasing lines associated with said ~~variable~~ voltage tunable dielectric capacitor to provide bias to said ~~variable~~ voltage tunable dielectric capacitors.
13. (Original) The voltage-controlled tunable comb-ring type filter of claim 12, wherein said biasing lines include four resistors to block any RF leakage into said DC biasing lines.
14. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, wherein any or all of said resonators can be implemented in a microstrip or stripline form.

15. (Original) The voltage-controlled tunable comb-ring type filter of claim 1, wherein any or all of said resonators can be bent towards each other to reduce the size of said filter.
16. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 1, wherein in ~~any or all of said resonators~~ at least one DC blocking capacitor ~~are~~ is used at the end of said ~~any or all of said first~~ resonators, said second resonator or said third resonator in order to bias any or all of said resonators.
17. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 10, further comprising a ring resonator circuit with a DC blocking capacitor at the opposite end of said ~~variable~~ voltage tunable dielectric capacitor position in order to make the whole structure symmetric.
18. Cancel claim 18.
19. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 18, wherein said voltage tunable dielectric capacitor includes a substrate having a low dielectric constant with planar surfaces.
20. (Original) The voltage-controlled tunable comb-ring type filter of claim 19, further comprising a tunable dielectric film on said substrate made from a low loss tunable dielectric material.
21. Cancel claim 21
22. Cancel claim 22.

23. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 24, further comprising a low loss isolation material used to isolate an outer bias metallic contact and the metallic electrode on said tunable dielectric material.

24. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 10, wherein the center frequency of the filter is tuned by changing the ~~varactor~~ voltage tunable dielectric capacitor capacitance controlled by changing the voltage applied to said ~~varactor~~ voltage tunable dielectric capacitor.

25. Cancel claim 25.

26. Cancel claim 26.

27. Cancel claim 27.

28. Cancel claim 28.

29. (Currently Amended) A method of filtering signals using a voltage-controlled tunable comb-ring type filter comprising the steps of:
providing a first ring or combline resonator;
coupling a second ring or combline resonator to said first resonator;
coupling a third resonator to said second resonator and cross coupling third resonator to said first resonator, wherein the cross coupling is realized by a transmission line shorted on both ends of at least one of said first, second or third resonators ~~or by placing a ring resonator in a different layer relative to a combline resonators or by keeping two comb line resonators straight and in proximity to a ring resonator.~~

30. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein said first resonator is a combline type resonator.

31. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein said second resonator is a ring type resonator.

32. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein said third resonator is a combline type resonator.

33. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, further comprising an input transmission line connected with said first resonator.

34. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, further comprising the step of providing an output transmission line connected with said third resonator.

35. Cancel claim 35.

36. Cancel claim 36.

37. Cancel claim 37.

38. Cancel Claim 38.

39. (Currently Amended) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein each of said first, second and third resonators includes at least one ~~variable~~ voltage tunable dielectric capacitor.

40. (Currently Amended) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, further comprising the step of providing bias to said ~~variable~~ voltage tunable dielectric capacitors by providing biasing lines associated with said ~~variable~~ voltage tunable dielectric capacitor.

41. ((Currently Amended)) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim ~~29~~40, wherein said biasing lines include four resistors to block any RF leakage into said DC biasing lines.

42. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein any or all of said resonators can be implemented in a microstrip or stripline form.

43. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein any or all of said resonators can be bent towards each other to reduce the size of said filter.

44. (Currently Amended) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, wherein in ~~any or all of said resonators~~ at least one DC blocking capacitor ~~are~~ is used at the end of said ~~any or all of said~~ first resonators, said second resonator or said third resonator in order to bias any or all of said resonators.

45. (Currently Amended) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim ~~38~~28, further comprising the step of providing a ring resonator circuit with a DC blocking capacitor at the opposite end of said ~~variable~~ voltage tunable dielectric capacitor position in order to make the whole structure symmetric.

46. Cancel claim 46.

47. (Currently Amended) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 46, wherein said voltage tunable dielectric capacitor includes a substrate having a low dielectric constant with planar surfaces.

48. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 47, further comprising the step of providing a tunable dielectric film on said substrate made from a low loss tunable dielectric material.

49. (Original) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 29, further comprising a metallic electrode with predetermined length, width, and gap distance associated with at least one resonator.

50. Cancel claim 50.

51. (Currently Amended) The method of filtering signals using a voltage-controlled tunable comb-ring type filter of claim 38, wherein the center frequency of the filter is tuned by changing the ~~varactor~~ voltage tunable dielectric capacitor's capacitance controlled by changing the voltage applied to said ~~varactor~~variable voltage tunable dielectric capacitor.

52. Cancel claim 52.

53. Cancel claim 53.
54. Cancel claim 54,
55. Cancel claim 55.
56. (Currently Amended) A voltage-controlled tunable comb-ring type filter comprising:
a plurality of resonators, said plurality of resonators comprising:
a first of at least two combline type resonators;
a first of at least one ring type resonator coupled to said first of at least two combline type resonator;
a second of said at least two combline type resonator coupled to said first of at least one ring type resonator and cross coupled to said first of at least two combline type resonators,
wherein the cross coupling is realized by a transmission line shorted on both ends of at least one of said first, second or third resonators ~~or by placing a ring resonator in a different layer relative to a combline resonators or by keeping two comb line resonators straight and in proximity to a ring resonator.~~
at least one of said plurality of resonators includes at least one ~~variable~~ voltage tunable dielectric capacitor;
an input transmission line connected with at least one of said plurality of resonators;
an output transmission line connected with at least one of said resonators[;].
57. Cancel claim 57.
58. Cancel claim 58.

59. Cancel claim 59.

60. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 57, further comprising biasing lines associated with said ~~variable~~ voltage tunable dielectric capacitor to provide bias to said ~~variable~~ voltage tunable dielectric capacitors.

61. (Original) The voltage-controlled tunable comb-ring type filter of claim 60, wherein said biasing lines include four resistors to block any RF leakage into said DC biasing lines.

62. (Original) The voltage-controlled tunable comb-ring type filter of claim 57, wherein any or all of said resonators can be implemented in a microstrip or stripline form.

63. (Original) The voltage-controlled tunable comb-ring type filter of claim 57, wherein any or all of said resonators can be bent towards each other to reduce the size of said filter.

64. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 57, wherein in ~~any or all of said resonators~~ at least one DC blocking capacitor ~~are~~ is used at the end of said ~~any or all of said~~ first resonators, said second resonator or said third resonator in order to bias any or all of said resonators.

65. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 57, further comprising a ring resonator circuit with a DC blocking capacitor at the opposite end of said ~~variable~~ voltage tunable dielectric capacitor position in order to make the whole structure symmetric.

66. Cancel claim 66.

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67. (Original) The voltage-controlled tunable comb-ring type filter of claim 66, wherein said tunable dielectric capacitor includes a substrate having a low dielectric constant with planar surfaces.

68. (Original) The voltage-controlled tunable comb-ring type filter of claim 67, further comprising a tunable dielectric film on said substrate made from a low loss tunable dielectric material.

69. Cancel claim 69.

70. (Currently Amended) The voltage-controlled tunable comb-ring type filter of claim 66, wherein the center frequency of the filter is tuned by changing the ~~varactor~~ voltage tunable dielectric capacitor's capacitance controlled by changing the voltage applied to said ~~varactor~~ voltage tunable dielectric capacitor.

71. Cancel claim 71.

IN THE SPECIFICATION

Please replace the two paragraph abstract with the single paragraph as follows:

--A voltage-controlled tunable comb-ring type filter which includes a plurality of resonators and wherein the plurality of resonators include a first of at least two combline type resonators, a first of at least one ring type resonator coupled to the first of at least two combline type resonator, a second of the at least two combline type resonator coupled to the first of at least one ring type resonator and cross coupled to the first of at least two combline type resonators, and at least one of the plurality of resonators includes at least one ~~variable~~ voltage tunable dielectric capacitor. An input transmission line is connected with at least one of the plurality of resonators and an output transmission line is connected with at least one of the resonators;.

~~The cross-coupling mechanism between the second of the at least two combline type resonators with the first of at least two combline type resonators can be through a transmission line shorted on all ends of the at least two combline type resonators or by placing the first of at least one ring type resonator in a different layer or by keeping all of the at least two combline type resonators relatively straight and placing the first of at least one ring type resonator such that cross-coupling occurs between the plurality of resonators by virtue of the proximity of all of the plurality of resonators. --~~

Please amend the paragraph beginning on page 2, line 17 as follows:

Inherent in every tunable filter is the ability to rapidly tune the response using high-impedance control lines. The assignee of the present invention has developed and patented tunable filter technology such as the tunable filter set forth in US Patent No. 6,525,630 entitled, "Microstrip tunable filters tuned by dielectric varactors", issued February 25, 2003 by Zhu et al. This patent is incorporated in by reference. Also, patent application ~~serial no. 09/457,943~~ publication no.

2002/0186099, entitled, "ELECTRICALLY TUNABLE FILTERS WITH DIELECTRIC VARACTORS" filed December 9, 1999, by Louise C. Sengupta et al. This application is incorporated in by reference.

Please amend the paragraph beginning on page 8, line 18 as follows:

--FIG. 6B graphically illustrates the response of the filter shown in FIG. 5 when tuned with high voltage[;].--

Please amend the paragraph beginning on page 11, line 13 as follows:

--In case of the combline resonators, the DC blocking capacitors are used at the end of the resonators as shown in FIG. 1. The DC blocking capacitor in the ring resonator is placed on the other end of the varactor position to make the overall filter structure symmetric. It is possible to use a conventional quarter-wave length long high impedance line with a quarter-wave length long radial stub for the biasing circuit. But it occupies a good amount of space, which makes the filter larger. The aforementioned Parascan® varactors developed by Paratek Microwave Inc., the assignee of the present invention, draw current in the range of few microamperes. The voltage drop in the resistor is almost negligible. Therefore, the biasing circuit for the varactors consists of short section of high impedance line and high resistor. The comb-ring type filter resonator is shown generally in FIG. 1 as 100 and now described more specifically includes a first DC bias 105, a second DC bias 110 and third DC bias 130. DC ground is provided at 115 and 185 with vias to ground shown at 125, 150, 170 and 190. Resist[er]s are integrated into the comb-ring type filter 100 at 142, 175 and 180. The combline resonators used in the present invention are illustrated at 135 and 155 with input line 137 associated with combline resonator 135 and output line 159 integrated with combline resonator 155. Coupling input line 137 and output line 155 is input-output coupling line 195. Ring resonator is depicted at 165 with DC blocking capacitor

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160 and varactor 157 associated therewith. Another DC blocking capacitor is shown at 122 and additional varactors depicted at 140 and 145.--

Please amend the paragraph beginning on page 12, line 9 as follows:

--The tuning characteristics of the filter is shown in Figures 2[A] and 2B. FIG. 2, shown generally as 200, graphically shows, in dB 205 vs. Frequency in GHz 210, insertion loss 230 and return loss 220. FIG. 2B, shown generally as 250, graphically shows, in dB 255 vs. Frequency in GHz 260 the return loss 265 and insertion loss 270.--